Microtrac S3000 Particle Size

S-3000 Technology Improves Accuracy and Consistency

The Microtrac S-3000 with Tri-laser Technology Increases Accuracy, Range, and Repeatability.

The Microtrac® S-3000 employs a patented Tri-laser technology to provide a more accurate particle size information, time after time. Even in the submicron range, measurements are made without the sample-to-sample variation evident in many other systems. By increasing the number of laser sources, Microtrac Inc.'s Tri-Laser technology makes a more effective use of photo-detection devices, part of the critical and sensitive components of the measurement system.

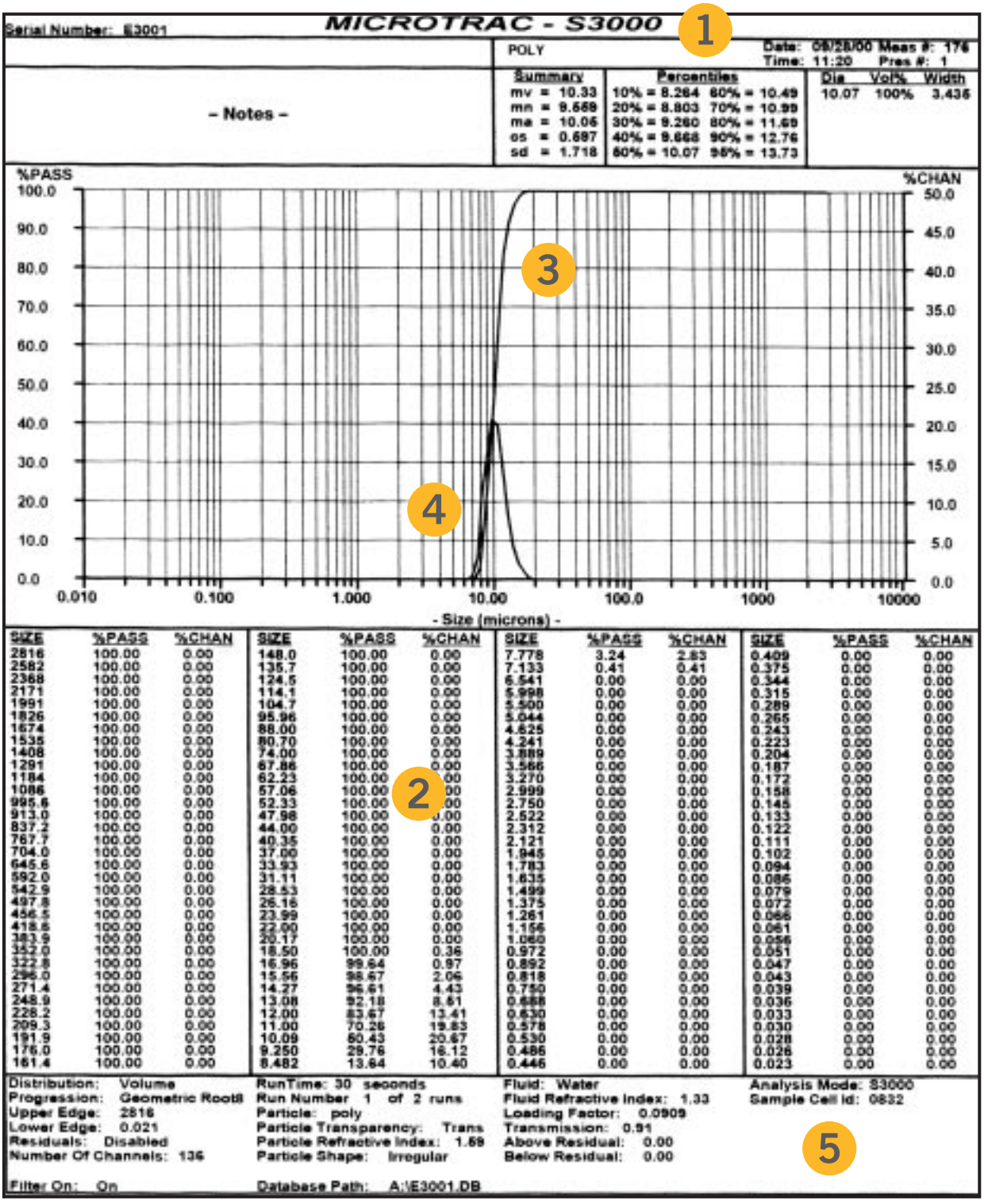
The Microtrac S-3000 offers these important benefits:

- Accuracy – A unique Tri-laser and multi detector optical system greatly improves resolution through the entire range of the S-3000 and enhances the submicron range.
- Consistency – The S-3000 series delivers repeatability and linearity, time after time.
- Range – Measurement accuracy from 0.024 to 2800 microns makes the S-3000 ideal for a wide range of applications.

Dry and Wet options – A variety of wet and dry sample delivery systems are available to interface to the S-3000 optical system. The S-3000 Microtrac system can be converted between wet or dry measurement in minutes. The options are selectable based on you application needs and can be expanded at any time because of our Modular Design, just contact your local representative at www.microtrac.com

Microtrac

MICROTRAC S3000 DATA DESCRIPTION



MICROTRAC - S3000

Serial Number: E3001

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POLY

Date: 05/28/00 Meas #: 176
Time: 11:20 Pres #: 1

– Notes –

Summary		Percentiles			Dia	Vol%	Width
mv = 10.33		10% = 8.264	60% = 10.49		10.07	100%	3.436
mn = 9.658		20% = 8.803	70% = 10.99				
ma = 10.05		30% = 9.260	80% = 11.69				
os = 0.697		40% = 9.668	90% = 12.76				
sd = 1.718		50% = 10.07	95% = 13.73				

%PASS 100.0 90.0 80.0 70.0 60.0 50.0 40.0 30.0 20.0 10.0 0.0

%CHAN 50.0 45.0 40.0 35.0 30.0 25.0 20.0 15.0 10.0 5.0 0.0

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0.010 0.100 1.000 10.00 100.0 1000 10000

- Size (microns) -

SIZE	%PASS	%CHAN	SIZE	%PASS	%CHAN	SIZE	%PASS	%CHAN	SIZE	%PASS	%CHAN
2816	100.00	0.00	148.0	100.00	0.00	7.778	3.24	2.83	0.409	0.00	0.00
2582	100.00	0.00	135.7	100.00	0.00	7.133	0.41	0.41	0.375	0.00	0.00
2368	100.00	0.00	124.5	100.00	0.00	6.541	0.00	0.00	0.344	0.00	0.00
2171	100.00	0.00	114.1	100.00	0.00	5.998	0.00	0.00	0.315	0.00	0.00
1991	100.00	0.00	104.7	100.00	0.00	5.500	0.00	0.00	0.289	0.00	0.00
1826	100.00	0.00	95.96	100.00	0.00	5.044	0.00	0.00	0.265	0.00	0.00
1674	100.00	0.00	88.00	100.00	0.00	4.625	0.00	0.00	0.243	0.00	0.00
1535	100.00	0.00	80.70	100.00	0.00	4.241	0.00	0.00	0.223	0.00	0.00
1408	100.00	0.00	74.00	100.00	0.00	3.889	0.00	0.00	0.204	0.00	0.00
1291	100.00	0.00	67.86	100.00	0.00	3.566	0.00	0.00	0.187	0.00	0.00
1184	100.00	0.00	62.23	100.00	0.00	3.270	0.00	0.00	0.172	0.00	0.00
1086	100.00	0.00	57.06	100.00	0.00	2.999	0.00	0.00	0.158	0.00	0.00
995.6	100.00	0.00	52.33	100.00	0.00	2.750	0.00	0.00	0.145	0.00	0.00
913.0	100.00	0.00	47.98	100.00	0.00	2.522	0.00	0.00	0.133	0.00	0.00
837.2	100.00	0.00	44.00	100.00	0.00	2.312	0.00	0.00	0.122	0.00	0.00
767.7	100.00	0.00	40.35	100.00	0.00	2.121	0.00	0.00	0.111	0.00	0.00
704.0	100.00	0.00	37.00	100.00	0.00	1.945	0.00	0.00	0.102	0.00	0.00
645.6	100.00	0.00	33.93	100.00	0.00	1.783	0.00	0.00	0.094	0.00	0.00
592.0	100.00	0.00	31.11	100.00	0.00	1.635	0.00	0.00	0.086	0.00	0.00
542.9	100.00	0.00	28.53	100.00	0.00	1.499	0.00	0.00	0.079	0.00	0.00
497.8	100.00	0.00	26.16	100.00	0.00	1.375	0.00	0.00	0.072	0.00	0.00
456.5	100.00	0.00	23.99	100.00	0.00	1.261	0.00	0.00	0.066	0.00	0.00
418.6	100.00	0.00	22.00	100.00	0.00	1.156	0.00	0.00	0.061	0.00	0.00
383.9	100.00	0.00	20.17	100.00	0.00	1.060	0.00	0.00	0.056	0.00	0.00
352.0	100.00	0.00	18.50	100.00	0.36	0.972	0.00	0.00	0.051	0.00	0.00
322.8	100.00	0.00	16.96	99.64	0.97	0.892	0.00	0.00	0.047	0.00	0.00
296.0	100.00	0.00	15.56	98.67	2.06	0.818	0.00	0.00	0.043	0.00	0.00
271.4	100.00	0.00	14.27	96.61	4.43	0.750	0.00	0.00	0.039	0.00	0.00
248.9	100.00	0.00	13.08	92.18	8.61	0.688	0.00	0.00	0.036	0.00	0.00
228.2	100.00	0.00	12.00	83.67	13.41	0.630	0.00	0.00	0.033	0.00	0.00
209.3	100.00	0.00	11.00	70.26	19.83	0.578	0.00	0.00	0.030	0.00	0.00
191.9	100.00	0.00	10.09	50.43	20.67	0.530	0.00	0.00	0.028	0.00	0.00
176.0	100.00	0.00	9.250	29.76	16.12	0.486	0.00	0.00	0.026	0.00	0.00
161.4	100.00	0.00	8.482	13.64	10.40	0.446	0.00	0.00	0.023	0.00	0.00

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Distribution: Volume
Progression: Geometric Root8
Upper Edge: 2816
Lower Edge: 0.021
Residuals: Disabled
Number Of Channels: 136

Filter On: On

RunTime: 30 seconds
Run Number 1 of 2 runs
Particle: poly
Particle Transparency: Trans
Particle Refractive Index: 1.59
Particle Shape: Irregular

Database Path: A:\E3001.DB

Fluid: Water
Fluid Refractive Index: 1.33
Loading Factor: 0.0909
Transmission: 0.91
Above Residual: 0.00
Below Residual: 0.00

Analysis Mode: S3000
Sample Cell Id: 0832

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The above represents a sample printout of particle size data obtained using the Microtrac® S3000 Analyzer. Data printouts for other Microtrac diffraction instrument models are interpreted similarly as presented below.

Primary Data Sections:

1. Sample information and summary data
2. Percent passing (retained) and percent in channel data
3. Cumulative volume graph
4. Relative volume graph
5. Measurement setup parameters

The following equations are used for computation of the values:

$$MV = \frac{\Sigma V_i d_i}{\Sigma V_i} \quad MN = \frac{\Sigma (V_i / d_i^2)}{\Sigma (V_i / d_i^3)} \quad MA = \frac{\Sigma V_i}{\Sigma (V_i / d_i)} \quad SD = \frac{(84\%-16\%)}{2}$$

1. Sample Information and Summary Data

If data are supplied from our Florida laboratory, it will contain the following information to identify and track the sample:

- A Microtrac laboratory tracking "ID"
- Your company name
- The time and date of the analysis.

Percentile

1% through 99% – Software-selectable **Percentile Points,** in microns, show the percentage of the volume (or weight, if the specific gravity for all the particles is the same) that is smaller than the size indicated. The "50" percentile is also known as the "median diameter," which is one of several measures of "average particle size."

Summary

mv – Mean Diameter, in microns, of the **Volume** distribution – represents the center of gravity of the distribution. Implementation of the equation used to calculate mv will show it to be weighted (strongly influenced) by coarse particles. It is another type of "average particle size."

mn – Mean Diameter, in microns, of the **Number** distribution – is calculated using the volume distribution data and is weighted to the small particles. This type of "average particle size" is related to population.

ma – Mean Diameter, in microns, of the **Area** distribution – is calculated from the volume distribution. The area mean is a type of "average" that is less weighted than **mv** by the presence of coarse particles, and therefore shows smaller particle size. Mean diameter represents a particle surface measurement.

cs – Calculated Specific Surface Area (M^2/CC) – provides an indication of specific surface area. The **cs** computation assumes smooth, solid, spherical particles. It should not be interchanged with BET or other adsorption methods of surface area determination. Calculated specific surface area does not reflect porosity or unique topographic characteristics of particles.

sd – Standard Deviation, in microns, describes the width of the measured particle size distribution. It does *not* provide an indication of the statistical error about the mean of multiple measurements.

Dia, Vol %, and Width – Microtrac software automatically separates the distribution into one or more peaks/modes. The following data pertain to individual peaks of the distribution:

Dia – the calculated 50% of each mode/peak in the distribution

Vol % – the percent volume contribution of each peak/mode to the distribution

Width – the 84% to 16% for each peak/mode of the distribution.

2. % PASS (%RETN) and % CHAN Numerical Data

The measuring range is divided into fixed "channel" or particle sizes. Particle sizes are identified on the left column in units of microns. Cumulative data values are on the same line as the particle size and are read "percent smaller than (or larger than) the particle size." Volume percent-in-channel data (%-CHAN) are read as "volume percent between the particle size on the same line and the line below."

For example, in the printout, 13.64% of the volume is smaller than 8.482 microns, while 10.40% of the material lies between the sizes 8.482 and 7.778 microns. When data are presented in the percent retained format (% RETN column), the data are read using 8.482 microns and the line above (9.250 microns).

3. Cumulative Graph

A cumulative graph, with "% PASS" or "% RETN" data, is presented as a line graph. The values used to produce the cumulative graph are those shown in the "% PASS" (%RETN) column in the numerical data. The percent value may be found by determining the point of intersection of the desired size and the cumulative curve; this is true for any particle size. The percent passing is determined from the point on the left axis that corresponds to the intersection point.

Microtrac only provides information within its particle size range. Particles smaller or larger than the instrument measuring range are not be included as part of the distribution. For this reason, "percent smaller or larger than" data begins with 100 % at the largest or smallest measurable size, even though particles outside the measuring range may be present in the sample.

4. Relative Graph (% CHAN)

When bar graphs are printed, midpoints between the channel sizes are used. Line graphs are developed by connecting the midpoints. Graphical data provide an opportunity to view the distribution at a glance. In the example, 5.00% of the volume is indicated at approximately 14 microns. Quantitative data are obtained from the numerical data in the table below the graph.

5. Measurement Parameters

Presented at the bottom of the page, this information relates to the measurement parameters used for data collection, calculations and final presentation of the distribution.

For more details on the data presentation or for information on our sample analysis services, please call Microtrac Technical Assistance, 1-888-643-5880 or 1-727-507-9770.